National Institute of Environmental Health Sciences

Uncertainty and risk in wildland fire management: A review

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Abstract:

Wildland fire management is subject to manifold sources of uncertainty. Beyond the unpredictability of wildfire behavior, uncertainty stems from inaccurate/missing data, limited resource value measures to guide prioritization across fires and resources at risk, and an incomplete scientific understanding of ecological response to fire, of fire behavior response to treatments, and of spatiotemporal dynamics involving disturbance regimes and climate change. This work attempts to systematically align sources of uncertainty with the most appropriate decision support methodologies, in order to facilitate cost-effective, risk-based wildfire planning efforts. We review the state of wildfire risk assessment and management, with a specific focus on uncertainties challenging implementation of integrated risk assessments that consider a suite of human and ecological values. Recent advances in wildfire simulation and geospatial mapping of highly valued resources have enabled robust risk-based analyses to inform planning across a variety of scales, although improvements are needed in fire behavior and ignition occurrence models. A key remaining challenge is a better characterization of non-market resources at risk, both in terms of their response to fire and how society values those resources. Our findings echo earlier literature identifying wildfire effects analysis and value uncertainty as the primary challenges to integrated wildfire risk assessment and wildfire management. We stress the importance of identifying and characterizing uncertainties in order to better quantify and manage them. Leveraging the most appropriate decision support tools can facilitate wildfire risk assessment and ideally improve decision-making.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Extreme Weather Event

Extreme Weather Event: Wildfires

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: ☑

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type: ☑

format or standard characteristic of resource

Review

Resilience: ☑

capacity of an individual, community, or institution to dynamically and effectively respond or adapt to shifting climate impact circumstances while continuing to function

A focus of content

Timescale: ☑

time period studied

Time Scale Unspecified